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Transforming Educational Theory into Usable Knowledge: A Case of Co-constructing Tools for Lesson Design and Reflection

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The weak impact of scientific publications on learning and teaching in the practice of schooling raises doubt about whether such knowledge is in fact usable in practice. The view of educational improvement, based on the assumption of a linear movement from fundamental research to practice, is increasingly seen as inadequate. What kinds of working relationships between researchers and practitioners support the construction of novel forms of teacher development that allow research-based knowledge on learning and teaching to be infused into systems of practice in ways that transform and advance existing practice? This question is discussed with respect to the development of Content-Focused CoachingSM, a professional development model, which includes a coach and a teacher or a group of teachers who jointly plan, enact and reflect on lessons. The model consists of a specific activity setting and a set of conceptual tools assisting coaches and teachers in conducting content-focused dialogues on the design of and the learning in lessons. Existence proofs have been accomplished for the teaching of elementary and middle school mathematics and elementary literacy.

Introduction

There is a new sense of urgency for schools to change. International studies comparing student achievements (e.g., TIMSS, PISA) and new forms of standards-based assessment and reporting of student achievement are making failures of schools more salient and public. Many schools and educational systems increasingly face public pressure to improve the quality of instruction.

In what ways can research in education help improve the quality of education? The old view of educational improvement, based on the assumption of a linear movement from fundamental research to practice, is increasingly seen as inadequate. Between educational systems and systems of educational research, there seems to be only a weak coupling, which we are just beginning to understand (Stein & Coburn, 2003). Even within the natural sciences, the prevailing conceptualization of the relationship between "basic" research and "applied" research is called into question. The still dominant understanding of technological innovations, seen as a linear transformation through the application of results from basic science to practical problems, is giving way to a more interactive and dynamic view. Stokes (1997) suggests a view of the relationship between

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science and technology that allows ”*for the critically important role of use-inspired basic research in linking the semiautonomous trajectories of scientific understanding and technological know-how*” (p. 89).

The history of past reform efforts in education has made clear that structural changes in schools alone are not sufficient to advance student learning (Elmore, 1996; Tyack & Cuban, 1995). Teacher development has been criticized for its lack of coherence with curricula and standards, for its theoretical nature of learning removed from practice-based settings, and for its negligible effects on transforming the practice of teaching (e.g., Hawley & Valli, 1999, Huberman, 1995; Joyce & Showers, 1995; Putnam & Borko 2000; Thompson & Zeuli, 1999). Very little is yet known about what teachers learn in a highly complex patchwork of informal, formal, mandatory, voluntary, planned and incidental learning (Wilson & Berne, 1999).

How can educational research contribute to the construction of novel forms of teacher learning and teacher development? How can available abstracted, research-based knowledge on learning and teaching be infused into systems of practice in ways that transform and advance existing practice? These are the main questions addressed in this chapter and discussed with respect to an exemplary innovative form of professional development called *Content-Focused Coaching* (Staub, West & Miller, 1998; Staub, 2001; Staub, West & Bickel, 2003). I first delineate different modes of interaction between research and practice and argue for the importance of collaborations between researchers and practitioners. In particular, I present a view of researcher–practitioner relationships that puts the co-construction of settings and tools for the development of practice at its core. Such a working relationship between research and practice has been the basis for the development of the first prototypes of Content-Focused Coaching, the kind of professional development model presented in the second part of the chapter.

Modes of interaction between research and practice

The conceptualization of the relationship between theory and practice is a continuing controversy, particularly as it applies to teacher education (in the German literature, see e.g., Bohnsack, 2000; Herzog, 2002; Moser, 1995; Tenorth, 1990).

Research can be understood to play different roles for the advancement of teaching and professional development. In the following, various modes of interactions between research and practice will be differentiated (for a more complete presentation see Staub, 2004). There is no claim for completeness. The primary purpose for the delineated modes is to highlight differences in terms of the nature of collaboration between basic research and fields of practice.

Practitioners as autonomous users of fundamental knowledge produced by basic research

The goal of research is to describe and explain basic phenomena. In teacher education the dissemination of general knowledge relevant for teaching and learning is based on the assumption that practitioners will make productive use of such knowledge.

The wealth of available (and often controversial) theories and findings from fields relevant to education, however, along with the expectation that practitioners will autonomously transfer and apply such knowledge to their everyday situations leaves practitioners with an enormously complex task.

Where researchers understand the production of general knowledge to be the sole goal of research, without taking on co-accountability for the dissemination and use of such knowledge to solve design tasks in specific fields of practice, there is no real interaction between research and systems of practice.

Research as the provider of fundamental knowledge for the development of technologies

The relation between educational research and practice can also be conceptualized in an analogy to engineering. Based on such a conceptualization, the role of research for the advancement of educational practice is to provide the fundamental basis for the development of technologies or design knowledge (e.g., Simon, 1981; Wittmann, 1995). According to Simon (1991), “*The professional schools will reassume their professional responsibilities just to the degree that they can discover a science of design, a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process*” (p. 132).

There is no agreement, however, about whether or not genuine technologies are in fact feasible in fields such as education. The history of education does not point to widely used and generally accepted practices derived from the application of theoretical knowledge to practical problems. In educational research, the analogies of success stories such as the pasteurization of milk in biology seem to be missing. Even the measurement of individual differences, one of the most established practices in educational research, can be challenged on the basis that the objectives of educational research are in principle culturally contestable issues (Bruner, 1999).

Scientific description and explanation of successful practices

A different relationship between research and practice is constituted if the main task of research is to capture and explain already existing forms of successful practice. Such research has been called *reverse engineering* (e.g., Colarelli, 1998). Based on such a view, research is asked to help us better understand and explain why existing practices are successful. A fundamental task of research is to develop reliable means for describing and documenting practices in order to arrive at shared understandings on what constitutes successful forms of practice.

Research of this type can make explicit the underlying (tacit) knowledge of successful practices and thus contribute to its transfer and dissemination. Because this kind of research draws from and is based on existing forms of practice, it does not allow for the creation of real innovations.

Design-experiments

Based on the work of Brown (1992) and Collins (1992), a new type of educational research explicitly aims to integrate basic research and the development of new forms of practice. In *design-experiments*, researchers engage in close collaboration with practitioners, and they are jointly accountable for the experiments carried out. Design-teams consisting of practitioners and researchers allow detailed local knowledge from the field of practice to be included in the design process, and the close collaboration is instrumental in ensuring that interventions are implemented as planned. Design experiments are to develop theories as well as new forms of practice through repeated cycles of designing, implementation, and analyses (cf. The Design-Based Research Collective, 2003). According to Cobb, Confrey, diSessa, Lehrer and Schauble (2003), “*The purpose of design experimentation is to develop a class of theories about both the process of learning and the means that are designed to support that learning, be it the learning of individual students, of a classroom community, of a professional teaching community, or of a school or school district viewed as an organization*” (p. 9/10). The scientific nature of this kind of research remains still controversial because of the complex methodological questions it raises (see Shavelson, Phillips, Towne & Feuer, 2003).

Researchers and practitioners co-construct settings and tools for the development of practice

This mode of interaction between research and practice involves close relationships between researchers and practitioners as well. In contrast to design-experiments, however, it does not presuppose that researchers have the power to implement. This mode of collaboration accepts the fact that researchers and practitioners operate in different systems of accountability, governed by different rules, norms and standards. The shared goal in this type of collaboration is to develop *settings* and *tools*, which can then be useful for practitioners to advance their practice (figure 1).

Based on a thorough understanding of the challenges and needs of the practitioners, researchers draw from their knowledge of relevant theories to develop conceptual tools that they believe will be useful for the practitioners to advance practice. Relevant elements from educational theory are selected and transformed into (verbal) representations that are easily accessible for practitioners. Researchers thus accept co-accountability for transforming theory into tools that will become “useful” for practitioners.

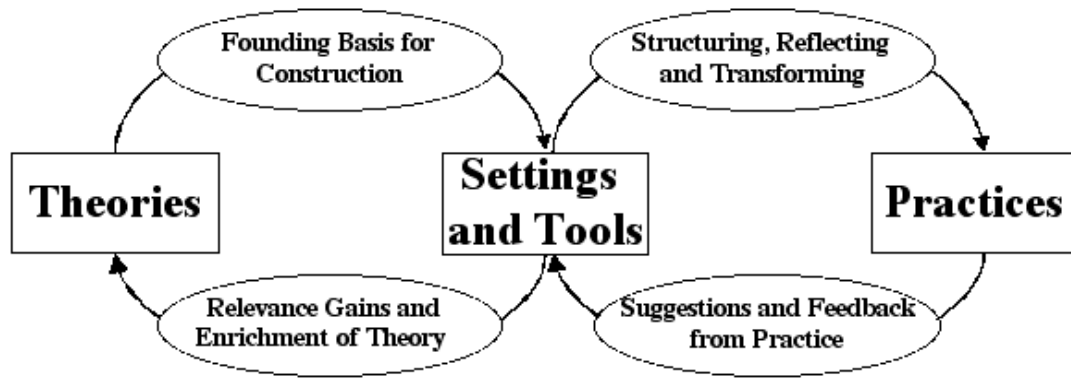


Fig 1: Co-construction of theory-based settings and tools for the development of practice

Given suggestions from researchers, it is left up to the practitioners to make use of the settings and tools to structure, reflect and develop their own practice. Emerging reports and observations with respect to the use (and non-use) of the tools and the settings provide feedback for the researchers to transform and refine them further. In addition, practitioners introduce their own ideas and suggestions for the transformation of settings or new kinds of tools deemed to be useful. Suggestions from practitioners need to be related by researchers to available theory, and their integration must be negotiated. The goal is to arrive at conceptual tools that are useful in practice, theoretically coherent, and communicable. Over time, on the basis of an iterative process, the initial set of tools will be collaboratively transformed and refined. If such collaboration is successful, the product will be a well-specified set of tools used in specific settings, which practitioners actually use to transform their practice.

The primary criterion for success in this kind of researcher–practitioner collaboration is the emergence of tools that are being used for the intended purpose and perceived to be useful by the practitioners. Data on use, appropriation and proliferation of such tools in a system of practice provide empirical evidence that the underlying theory of such tools is useful in the particular field of practice to which it has been applied. This in turn enriches the underlying theory and demonstrates its relevance.

The tools, the settings in which they are used, along with documentation of exemplary practices and theoretical explanations, all capture the emerging practice as a *prototype*. Explicit representations of such prototypes can become the basis for transfer and dissemination beyond the initial researcher–practitioner collaborations. Furthermore, successful prototypes of new kinds of practices can become the object of further research, based on different modes of interaction between science and practice.

Content-Focused Coaching: An activity setting for the use of conceptual tools for lesson design and reflection

Leading academic institutions for education research with institutional structures that allow researchers and practitioners to engage in long-term collaborations are still rare. A pioneering institution to take up this challenge is the Institute for Learning (IFL). It was founded in 1995 by Lauren B. Resnick as a new organizational structure within the University of Pittsburgh's Learning Research and Development Center. The Institute for Learning's "mission is to provide educators with the resources and training they need to enhance learning opportunities for all students. The Institute serves as a think tank, a design center for innovative professional development systems in the schools, and an educator of core groups of school professionals" (www.instituteforlearning.org/ 20.8.2003).

Content-Focused CoachingSM (CFC) is one of the Institute for Learning's systems for professional development (Staub, Mahon & Miller, 1998; Staub, West & Bickel, 2003; see also: www.instituteforlearning.org/develop.html). Originally it was developed for mathematics instruction (in collaboration with school districts such as Monaca, PA, Woodland Hills, PA, and New York City School District 2). More recently, Content-Focused Coaching has been applied to primary literacy instruction (in Kansas City, MO, Providence, RI, Los Angeles, CA, and Denver, CO; Staub & Bickel, 2003). Content-Focused CoachingSM consists of specific activity settings and a set of theory-based conceptual tools to assist coaches and teachers in jointly planning, teaching, and reflecting on rigorous lessons.

The Institute for Learning's Principles of Learning

The work at the IFL evolved around a set of Principles of Learning, drawn from research in cognitive psychology (Resnick, 1995). Resnick argues that creating an educational system that enables the population at large to achieve a high level of skill and ability requires a profound transformation of basic assumptions about the enabling conditions for learning. Such essential features are made explicit in the form of Principles of Learning, which are intended to provide guidelines for organizing learning and instruction environments and the kind of curricula and pedagogy that will help all students work toward achieving rigorous academic standards. In collaboration between practitioners and researchers, the Principles of Learning have continuously been discussed, elaborated, exemplified and used as conceptual tools to reflect on and design learning and teaching in specific schools (Resnick & Hall, 1998, 2001). Two of the nine Principles of Learning follow (www.instituteforlearning.org/index.html, 10.6.2003):

Clear Expectations

If we expect all students to achieve at high levels, then we need to define explicitly what we expect students to learn. These expectations need to be communicated clearly in ways that get them "into the heads" of school professionals, parents, the community and, above all, students themselves. Descriptive criteria and models of

work that meet standards should be publicly displayed, and students should refer to these displays to help them analyze and discuss their work. With visible accomplishment targets to aim toward at each stage of learning, students can participate in evaluating their own work and setting goals for their own effort.

Academic Rigor in a Thinking Curriculum

Thinking and problem solving will be the "new basics" of the 21st century. But the common idea that we can teach thinking without a solid foundation of knowledge must be abandoned. So must the idea that we can teach knowledge without engaging students in thinking. Knowledge and thinking are intimately joined. This implies a curriculum organized around major concepts that students are expected to know deeply. Teaching must engage students in active reasoning about these concepts. In every subject, at every grade level, instruction and learning must include commitment to a knowledge core, high thinking demand, and active use of knowledge.

For such general and abstract principles to be of practical use, they need to be taken into account in the kind of reasoning that teachers use daily in the classroom. Content-Focused Coaching was developed to assist teachers in planning, teaching, and reflecting on their work in ways that create learning environments that are in line with these Principles of Learning.

The main goals of Content-Focused Coaching

The main goals of CFC include:

- Assisting teachers "on the job" to plan, teach and reflect on their lessons
- Fostering teachers' habits of mind in lesson design and reflection on teaching
- Enriching, refining and transforming teachers' pedagogical content knowledge
- Developing teachers' capacity to communicate with other teachers about teaching and learning.

Activity-settings for Content-Focused Coaching

CFC is situated in schools where a coach works with teachers in learning groups and/or individually. The coaching based on individual conferring includes pre-lesson conferences, the enactment of lessons, and post-lesson conferences. Lesson planning, the teaching of lessons, and reflection on lessons constitute three basic settings for didactic reasoning.

The purpose of *pre-lesson conferences* is for coaches to understand a teacher's goals and the reasoning underlying the teacher's plan for the lesson and to engage in a constructive dialogue on how to foster student learning successfully. During this process the coach becomes acquainted with the teachers' thinking, beliefs, and knowledge, and the teacher and the coach learn to design and refine lessons collaboratively.

The coach's role *during the enactment of lessons* can vary considerably. Coach and teacher negotiate in pre-lesson conferences on how to collaborate during a lesson. The

coach's involvement may range from *observing* only, to *co-teaching* the lesson, to *modeling* all or part of a lesson while the teacher observes. Because lesson plans are shared or co-constructed during pre-lesson conferences, the coach and the teacher are jointly responsible for these lessons. Even during lessons that are taught primarily by the classroom teacher, the coach's role is highly collaborative and may involve different forms of – previously negotiated – intervention and participation.

During *post-lesson conferences*, the teacher and the coach jointly reflect on the lesson. Was the lesson plan implemented successfully? Did the students reach the intended goals? This joint evaluation often includes the study of student work. Post-lesson conferences often segue into pre-conferences for the next lesson.

The activity setting for CFC is based on the assumption that teachers learn and develop their teaching expertise through collaboration with a coach in planning, enactment and reflection of lessons. Coaching conversations are oriented toward the content of student learning and strive for a high degree of specificity. The coach is considered to be co-accountable for the design and the enactment of lessons. Although the coach needs to have a high degree of content knowledge and expertise in pedagogy, he or she also takes a learning stance. Theory-based conceptual tools provide a guiding frame for the design of coaching conversations.

The Guide to Core Issues for Lesson Design and Reflection

During coaching conversations many different issues can emerge. On what issues should such conversations focus? The guiding Principles of Learning are very abstract. In order for coaching conversations about lessons to reach a content-specific level, CFC makes use of an additional kind of tool: the Guide to Core Issues in Lesson Design. The development of these Core Issues also drew upon European theories of didactics for lesson planning (Klafki, 1958; 1995) and Aebli's cognitively based general theory of teaching (Aebli, 1983). The Core Issues emerged over a number of years from the kind of interaction between researchers and practitioners that is referred to as *co-construction of tools* in the first part of this chapter. The Core Issues constitute one of the pivotal tools for CFC.

What is the mathematics in this lesson?

- What is the specific mathematics goal of this lesson?
- Are there specific strategies being developed? Explain.

Where does this lesson fall in this unit and why?

- Do any of these concepts and/or skills get addressed at other points in the unit?
- Which standards does this particular lesson address?

What are students' prior knowledge and difficulties?

- What relevant contexts could you draw on in relation to this concept?
- What can you identify or predict students may find difficult or confusing or have misconceptions about?

How does the lesson help students reach the goals?

- What activities will move students toward the stated goals?
 - In what ways will students make their mathematical thinking and understanding public?
 - How do you plan to assist those students whom you predict will have difficulties?
-

Fig. 2: Exemplary Core Issues in Mathematics Lesson Design (from Staub, West & Bickel, 2003)

Core Issues are not to be used verbatim or in a mechanical way. The particular issues to be addressed and their specific wording need to be adapted based on the coach's knowledge of and relationship with the teacher (for rich examples see the case studies in West & Staub (2003), which are illustrated episodes on CDs).

Conclusions

In what ways can educational research help to improve the quality of education? To address this question, different modes of interactions between researchers and practitioners have been delineated. This conceptualization is based on the assumption that, for researchers in educational science to effectively contribute to the development of relevant opportunities for teacher learning and professional development, they need to engage in collaborations with systems of practice. More specifically, a working relationship was proposed that relates researchers and practitioners through the shared goal of co-constructing settings and tools that create new opportunities for teachers' professional development.

Content-Focused CoachingSM, as developed in collaboration with University of Pittsburgh's Institute for Learning and its partner districts, was referred to as an example for research and development work that involves such co-construction between researchers and practitioners. The development of prototypes of CFC, as described, for example, in West and Staub (2003), can be understood to represent what Bruner (1999) refers to as "existence theorem" research projects. It establishes a new way of initiating and orchestrating teacher development.

The underlying theory and documentation of prototypes of Content-Focused Coaching in practice can be used as a basis and a blueprint for further dissemination and transfer. Along with transfer and implementation studies, we now need studies on the effects of this approach that go beyond the criteria based on which professional developers and teachers have found it helpful. The new practice of Content-Focused Coaching thus needs to become the object of further research.

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